

Appl. No. 09/937,538
Amtd. Dated March 5, 2004
Reply to Office Action of December 8, 2003

Attorney Docket No. 81839.0102
Customer No.: 26021

REMARKS/ARGUMENTS

Claims 1-18 are pending in the Application. By this amendment, claim 1 is being amended to improve its form. No new matter is involved.

On page 2 of the Office Action, claim 1 is rejected under 35 U.S.C. § 102(b) as being anticipated by JP 09015174 (JP '174). On page 3 of the Office Action, claim 7 is rejected under 35 U.S.C. § 103(a) as being unpatentable over JP '174 in view of U.S. Patent 6,444,010 of Watanabe. These rejections are respectfully traversed.

Claim 1 is being amended to add the feature in accordance with the present invention of "evaluate concentration of metal impurities contained in the silicon wafer". This should make clear the difference between the present invention and JP '174. As so amended, claim 1 reads as follows:

1. A method for evaluating concentration of metal impurities contained in a silicon wafer, which comprises dropping concentrated sulfuric acid onto a surface of the silicon wafer to extract metal impurities solid-solubilized in the inside of the silicon wafer into the concentrated sulfuric acid, and chemically analyzing metal impurities contained in the concentrated sulfuric acid to evaluate concentration of metal impurities contained in the silicon wafer. (Emphasis added).

The present invention has features which distinguish from the prior art, as set forth in lines 2-11 of page 7 for example, wherein it is stated "The metals once recovered in the concentrated sulfuric acid scarcely diffuse again into the inside of the bulk, and thus the metals can be efficiently extracted to the wafer surface. Further, the wafer surface is unlikely to be roughened, and therefore favorable evaluation of wafer can be performed. Moreover, since the evaluation can be performed by using a few drops of concentrated sulfuric acid, the influences of sulfuric acid such as decrease of analytical sensitivity can be minimized."

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Therefore, according to a method for evaluating in the case of the present invention, because the recovery yield of metals from inside the wafer is increased, it is possible to obtain the effect that it enables quantitative evaluation of a low resistivity wafer, which has not been capable of evaluation, thus far. Further according to the invention, it is possible to obtain the effect that fluctuation of precision due to exogenous factors is also suppressed, and the method enables detection even at a low Cu concentration, if the Cu is contained at a concentration of $1 \times 10^{9-11}$ atoms/cm³ or more, and sensitivity and measurement precision are also improved (see the discussion at line 10 of page 11 through line 1 of page 12 of the specification).

According to the Office Action, JP '174 discloses a method for chemical analysis of a surface of a silicon wafer. However, such assertion is erroneous. JP '174 discloses subject matter relevant to a method for analysis of a chemical, as is made clear from the title of the reference. The JP '174 reference does not describe a method for evaluating concentration of metal impurities contained in a silicon wafer, as in the case of the present invention.

More specifically, and as translated into English, claim 1 of the JP '174 reference recites "A method for analysis of a chemical which comprises placing a silicon wafer having a clean surface into a closed vessel under reduced pressure, evaporating the chemical dropped on the surface of the wafer by heating, dropping a very small amount of recovery solution containing fluoric acid on the wafer surface, running the recovery solution over the whole surface of the wafer to recover an evaporation residue, analyzing the recovery solution to analyze impurities contained in the chemical." This is a translation of claim 1 as provided by Applicant, and is slightly different from a computer translation into English of the

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JP '174 reference by the Japanese Patent Office. Such a translation is attached hereto as an unofficial English translation for the Examiner's information.

Thus, in the JP '174 reference, the silicon wafer is used only as a tool for heating and evaporation of the chemical such as sulfuric acid which is an object for evaluation. There is no description that metal impurities contained in the silicon wafer are evaluated, or further that metal impurities contained in the silicon wafer are extracted. An object for analysis, in the JP '174 reference, is fundamentally impurities in a chemical such as sulfuric acid and so on, and which is not metal impurities contained in a silicon wafer as in the case of the present invention.

Therefore, the JP '174 reference relates to a method for analyzing of impurities contained in a chemical, and does not disclose a method for chemical analysis of a surface of a silicon wafer, contrary to what is stated in the Office Action. Nor does such reference relate at all to a method for evaluating concentration of metal impurities contained in a silicon wafer, unlike the present invention.

Therefore, the JP '174 reference has no relationship to the present invention. Nor does the JP '174 reference disclose or suggest the features in accordance with claim 1 of dropping concentrated sulfuric acid onto a surface of the silicon wafer to extract metal impurities solid-solubilized in the inside of the silicon wafer into the concentrated sulfuric acid, and chemically analyzing metal impurities contained in the concentrated sulfuric acid. Therefore, it should be clear that claim 1 of the present invention is quite different from the JP '174 reference. However, the reference has no relationship to the present invention and does not disclose or suggest the feature in accordance with the present invention, and cannot achieve the effect of the present invention as described above.

Again, the JP '174 reference relates to a method for analyzing of impurities in a chemical, and has no relationship to the present invention which involves a method for evaluating concentration of metal impurities in a silicon wafer. Moreover, the JP '174 reference neither describes nor suggests the feature in accordance with claim 1 of the present application. Therefore, it is clear that claim 1 is substantially different from the JP '174 reference.

A person skilled in the art could not derive the present invention from the JP '174 reference. Such reference does not disclose or suggest evaluating concentration of metal impurities contained in the silicon wafer, or extracting metal impurities solid-solubilized in the inside of the silicon wafer into the concentrated sulfuric acid, or chemically analyzing metal impurities contained in the concentrated sulfuric acid. Moreover, and as previously described, the invention as defined in claim 1 achieves the excellent effect of enabling quantitative evaluation of a low resistivity wafer, and this has not heretofore been possible. The present invention has the further advantageous effect that fluctuation of precision due to exogenous factors is also suppressed. The method in accordance with the present invention enables detection, even at a low Cu concentration, if the Cu is contained at a concentration of $1 \times 10^{9-11}$ atoms/cm³ or more, and sensitivity in measurement precision are also improved.

For these reasons, claim 1 as amended herein is submitted to clearly distinguish patentably over the prior art.

Regarding rejected claim 7, such claim depends from and contains all the limitations of claim 1 from which it depends. Therefore, claim 7 is also submitted to clearly distinguish patentably over the art.

On page 4 of the Office Action, claims 2-6 and 8-18 are objected to as being dependent upon a rejected base claim, but are indicated as being allowable if

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rewritten in independent form so as to include all of the limitations of the base claim and any intervening claims. Such indication has been duly noted by Applicant. However, Applicant has not rewritten such claims in independent form at this time, inasmuch as claim 1 as amended herein and claim 7 which depends therefrom are submitted to clearly distinguish patentably over the art for the reasons discussed above.

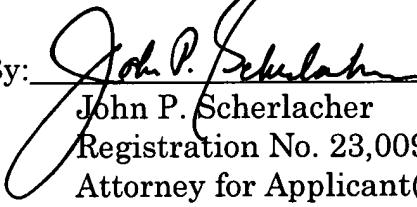
In conclusion, claims 1 and 7 are submitted to clearly distinguish patentably over the prior art, in addition to claims 2-6 and 8-18. Therefore, reconsideration and allowance are respectfully requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (213) 337-6846 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
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Date: March 5, 2004

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